

REMARKS

Claims 1, 4-14 and 19-28 are pending in the present application, and are rejected. Claims 13-28 are herein canceled. Claim 1 is herein amended. New claims 29-38 are herein presented. No new matter has been added.

Double Patenting

The Examiner asserts that if claim 13 be found allowable, claim 19 will be objected to under 37 C.F.R. §1.75 as being a substantial duplicate thereof.

Applicants herein cancel claims 13-28, thus mooting the rejection.

Rejections under 35 U.S.C. §103(a)

Claims 19-22 are rejected under 35 U.S.C. §103(a) as being unpatentable over Yonehara in view of AAPA and Steckl et al.

Claims 23-27 are rejected under 35 U.S.C. §103(a) as being unpatentable over Yonehara et al, AAPA and Steckl et al. as applied to claim 19 above, and further in view of Fitzgerald (US 2002/0123167 A1).

Claim 28 is rejected under 35 U.S.C. §103(a) as being unpatentable over Yonehara et al. as, AAPA and Steckl et al. applied to claim 19 above, and further in view of Hurley (5,698,474).

Applicants had previously asserted an argument against the rejections based on an allegation of unexpected results.

Examiner asserts that Applicants argue based their *rationale* for the claimed upper limit for the boron concentration and that the rationale is absent in Yonehara et al., and asserts that a different *rationale* for reaching the same limitation is not a proper method for distinguishing over cited art.

However, the Examiner fails to properly characterize Applicants' argument as asserting that, in addition to the rationale, the claimed *upper limit* was also missing from Yonehara et al. Because the claimed upper limit for the boron concentration was also missing from Yonehara et al., Applicants properly indicated that the claimed range produced unexpected results in the portion of the claimed range that minimally overlaps that of Yonehara et al.

With respect to the rationale for the upper limit of 10^{17} cm⁻³ boron atoms, Applicants noted that the specification indicates that the upper limit is based on the present Inventors' finding that silicon substrates having boron concentrations of 2×10^{17} (atoms/cm³) or lower can be evaluated as having no autodoping problem. On the other hand, silicon substrates having boron concentrations of greater than 2×10^{17} (atoms/cm³) are evaluated as exhibiting autodoping problems. Applicants noted that the presence or absence of autodoping at the different levels of boron concentration would have been unexpected in light of the teachings of the cited references. One skilled in the art at the time of the invention would not have known that a limit of 2×10^{17} (atoms/cm³) or lower would have resulted in silicon substrates that have no autodoping problem. The lack of autodoping problem would have been unexpected, and therefore the claimed range of boron concentration provides an unexpectedly superior result over what would have been expected.

Applicants had further noted that the claimed range of boron resulted in further unexpected results with respect to high gettering ability not only for iron atoms (as mentioned in Specification) but also for nickel atoms within a range of the boron at a concentration not lower than 5×10^{16} (atoms/cm³) nor higher than 2×10^{17} (atoms/cm³). Applicants had submitted a Reference Figure that graphically showed further evidence of unexpectedly superior results. The Examiner considered the data and determined that the sum of experimental data was not commensurate with the claims.

In addition to the above arguments for patentability, Applicants herein amend claim 1 to provide additional patentable distinction. Thereafter, Applicants disagree with the rejection because not all of the claimed limitations are taught or suggested by the cited references, alone or in combination. Claim 1 now recites the limitation "wherein said semiconductor substrate contains carbon at a concentration of 1×10^{15} (atoms/cm³) or higher."

Applicants note that in Steckl et al., it is disclosed that in substrate of SOI structure, the silicon layer is formed on a SiC layer by a carbonization reaction, and SiC layer is epitaxially-formed. In Steckl et al., there is neither teaching nor suggestion about carbon concentration in SiC layer.

In contrast, in the present invention, the semiconductor substrate is formed to meet the relation to $[B] \geq (2.2 \pm 0.2) \times 10^{16} \exp(0.21t)$, as defined the range of SFQR value ≤ 70 nm, and the boron concentration higher than or equal to 5×10^{16} /cm³ and lower than or equal to 2×10^{17} /cm³. Therefore, the present invention realizes a good semiconductor substrate with both superior autodoping properties and gettering ability. Further, as disclosed on page 17, line 28 –

page 18, line 13, and page 26 line 4 – 16 etc., because the gettering ability is provided by defining the boron concentration within a limited intermediate value as described the above, the semiconductor substrate which contains carbon at a concentration higher than or equal to $1 \times 10^{15}/\text{cm}^3$ by doping and lower than or equal to $5 \times 10^{16}/\text{cm}^3$ in claim 29 is realized. Applicants note that there is no way to define the carbon concentration strictly except for doping. It is impossible for the method of forming SiC layer, for example, carbonization reaction to define.

As described above, there is no disclosure in Steckl et al. about the specific example of carbon concentration to realize sufficient gettering ability. To control the carbon concentration properly as the present invention, doping must be used. Claim 1 of the present invention can not be reached if Yonehara et al.(and AAPA) and Steckl et al. are combined because it is impossible for the method of forming SiC layer, for example, carbonization reaction to realize sufficient gettering ability.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

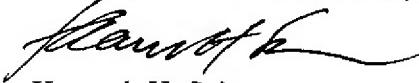
Application No. 10/743,793
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Amendment under 37 C.F.R. §1.114
Amendment filed October 31, 2007

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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